

WHAT IS CLAIMED IS:

1. A power supply apparatus for a vehicle, comprising:
 - a power feed portion including a power storage portion and a
 - 5 power generating portion, the power storage portion including a storage battery, the power storage portion and the power generating portion transmitting and receiving electric power to and from each other, the power feed portion feeding electric power to a plurality of on-vehicle loads; and
 - 10 a control portion for controlling the electric power fed from the power feed portion to the on-vehicle loads; wherein the control portion includes means for, in cases where the sum of feedable electric power is smaller than the sum of required electric power or in cases where an electric quantity
 - 15 related to the sum of feedable electric power is smaller than an electric quantity related to the sum of required electric power, increasing the sum of feedable electric power or decreasing the sum of required electric power, wherein the sum of feedable electric power is equal to electric power which can be fed from the power feed portion to the on-vehicle loads, and which contains electric power generated by the power generating portion and electric power feedable from the storage battery, and wherein the sum of required electric power is equal to the sum of electric power consumed by the on-vehicle loads.
- 25 2. A power supply apparatus as recited in claim 1, wherein the

control portion includes means for, in cases where the discharge electric power of the storage battery exceeds a prescribed allowable maximum value or a prescribed reference value, increasing the generated electric power or decreasing the sum of required electric power.

3. A power supply apparatus as recited in claim 1, wherein the control portion includes means for, in cases where it is judged that the sum of feedable electric power or a near-future prediction value thereof exceeds the sum of required electric power or a near-future prediction value thereof, increasing the sum of feedable electric power or decreasing the sum of required electric power.

4. A power supply apparatus as recited in claim 3, wherein the control portion includes means for calculating the sum of required electric power or the near-future prediction value thereof on the basis of detected operating conditions of the vehicle or conditions of drive of the on-vehicle loads.

5. A power supply apparatus as recited in claim 1, wherein the control portion includes means for increasing the sum of feedable electric power by increasing the electric power generated by the power generating portion.

6. A power supply apparatus as recited in claim 5, wherein the control portion includes means for giving preference to increasing

the electric power generated by the power generating portion over decreasing the sum of required electric power.

7. A power supply apparatus as recited in claim 1, wherein the
5 control portion includes means for decreasing the sum of required
electric power by suspending prescribed ones of the on-vehicle
loads, reducing drive rates of the prescribed ones of the on-vehicle
loads, or implementing change from continuous power feed to the
prescribed ones of the on-vehicle loads to intermittent power feed
10 thereto on a temporally offset basis.

8. A power supply apparatus as recited in claim 1, wherein the
control portion includes means for, in cases where the sum of
feedable electric power exceeds the sum of required electric power,
15 decreasing the electric power generated by the power generating
portion or recovering the sum of required electric power so as to
converge charge and discharge electric power of the storage battery
on zero while the amount of electric power remaining in the storage
battery is in a prescribed range.

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9. A power supply apparatus as recited in claim 8, wherein the
control portion includes means for giving preference to recovering
the sum of required electric power over decreasing the electric
power generated by the power generating portion.

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10. A power supply apparatus as recited in claim 1, wherein the

power storage portion includes a first storage battery for feeding electric power to a first on-vehicle load group, a second storage battery for feeding electric power to a second on-vehicle load group, and a DC-DC power converting portion for transmitting interchange 5 electric power between the first and second storage batteries, and wherein the control portion includes means for adjusting electric power required by the first and second on-vehicle load groups, the electric power generated by the power generating portion, or the interchange electric power transmitted between the first and 10 second storage batteries so that the sum of feedable electric power for the first on-vehicle load group will exceed the sum of required electric power on the first on-vehicle load group, and that the sum of feedable electric power for the second on-vehicle load group will exceed the sum of required electric power on the second on-vehicle 15 load group.

11. A power supply apparatus as recited in claim 10, wherein the control portion includes means for giving preference to adjusting the electric power generated by the power generating portion over 20 adjusting the interchange electric power.

12. A power supply apparatus as recited in claim 1, wherein the power storage portion includes a first storage battery for feeding electric power to a first on-vehicle load group, and a second storage 25 battery for feeding electric power to a second on-vehicle load group, wherein the power generating portion includes a first AC-DC power

- converting portion for transmitting and receiving electric power to and from the first storage battery, and a second AC-DC power converting portion for transmitting and receiving electric power to and from the second storage battery, and wherein the control
- 5 portion includes means for adjusting electric power required by the first and second on-vehicle load groups or electric power generated by the first and second AC-DC power converting portions so that the sum of feedable electric power for the first on-vehicle load group will exceed the sum of required electric power on the first on-
- 10 vehicle load group, and that the sum of feedable electric power for the second on-vehicle load group will exceed the sum of required electric power on the second on-vehicle load group.
13. A power supply apparatus as recited in claim 1, wherein the control portion includes means for, in cases where a command to change the sum of required electric power is given and then the resultant sum of required electric power is equal to or greater than the sum of feedable electric power, permitting the execution of the command to change the sum of required electric power at or after
- 15 the moment of instructing an increase in the sum of feedable electric power or a decrease in the sum of required electric power so that the sum of feedable electric power can exceed the resultant sum of required electric power.
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- 25 14. A power supply apparatus as recited in claim 13, wherein the control portion includes means for, regarding ones of the on-vehicle

loads which can be driven at drive rates in prescribed ranges, driving the ones of the on-vehicle loads at the drive rates in the prescribed ranges when a command to drive the ones of the on-vehicle loads is given.

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15. A power supply apparatus as recited in claim 1, wherein the power generating portion includes an electric generator/motor driven by an engine, and wherein the control portion includes means for enabling the power storage portion to maintain a discharge power quantity allowing the engine to start during a time interval except a first time period immediately after a given number of times of engine-start discharging of the power storage portion and a second time period for which the engine is starting.
- 10 16. A power supply apparatus as recited in claim 1, wherein the power generating portion includes an electric generator/motor driven by an engine, and wherein the control portion includes means for, in cases where suspension of the engine during a prescribed short time interval is predicted, storing a prescribed portion of a discharge power quantity in the power storage portion before the engine is suspended.
- 15 20 25 17. A power supply apparatus as recited in claim 7, wherein the control portion includes means for suspending the prescribed ones of the on-vehicle loads or reducing the drive rates of the prescribed ones of the on-vehicle loads to decrease the sum of required

electric power in an order opposite an importance-based order predetermined in accordance with the degrees of importance of the on-vehicle loads.

5 18. A power supply apparatus as recited in claim 17, wherein the control portion includes means for altering the importance-based order by a change pattern predetermined on the basis of detected vehicle operating conditions or drive conditions of the on-vehicle loads.

10 19. A power supply apparatus as recited in claim 1, wherein the control portion includes means for, in cases where the electric power generated by the power generating portion is greater than the sum of required electric power by a prescribed value or more, 15 decreasing the electric power generated by the power generating portion or increasing the sum of required electric power.

20 20. A power supply apparatus as recited in claim 19, wherein the control portion includes means for, in cases where charge electric power of the storage battery exceeds a prescribed allowable maximum value or a prescribed reference value, decreasing the electric power generated by the power generating portion or increasing the sum of required electric power.

25 21. A power supply apparatus for a vehicle, comprising:
a power feed portion including a power storage portion and a

power generating portion, the power storage portion including a storage battery, the power storage portion and the power generating portion transmitting and receiving electric power to and from each other, the power feed portion feeding electric power to a plurality of on-vehicle loads; and

5 a control portion for controlling the electric power fed from the power feed portion to the on-vehicle loads;

wherein the control portion includes means for, in cases where the sum of required electric power exhibits a variation,

10 detecting the variation in the sum of required electric power on the basis of drive conditions of the on-vehicle loads or conditions of currents, means for changing electric power generated by the power generating portion in response to the detected variation, and means for, in cases where an increase in the sum of required

15 electric power can not be met by an increase in the electric power generated by the power generating portion, discharging the storage battery to compensate for the difference therebetween, and wherein the sum of required electric power is equal to the sum of electric power consumed by all of electrically-powered loads including the

20 on-vehicle loads.

22. A power supply apparatus as recited in claim 10, wherein the power generating portion includes an electric generator/motor driven by an engine, and wherein the control portion includes

25 means for, in cases where the sum of feedable electric power is smaller than the sum of required electric power or it is predicted

that the sum of feedable electric power is smaller than the sum of required electric power, giving preference to decreasing the sum of required electric power or adjusting the interchange electric power over starting the engine when the engine is at rest.

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23. A power supply apparatus as recited in claim 1, wherein the control portion includes means for calculating the sum of required electric power by adding a basic required required power value and a consumed power value, the basic required power value corresponding to the rate of electric power fed to small-rating power loads and prescribed important loads, the consumed power value corresponding to the total rate of consumption of electric power by the on-vehicle loads.
- 10 24. A power supply apparatus as recited in claim 1, wherein the control portion includes means for calculating or storing priority points of the on-vehicle loads which are as functions of basic points given to the on-vehicle loads for respective evaluation factors, and means for setting an order in which the sum of required electric power is decreased in accordance with the magnitudes of the priority points.
- 15 25. A power supply apparatus as recited in claim 24, wherein the priority points or the basic points of prescribed ones of the on-vehicle loads are variable in time domain.
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26. A power supply apparatus as recited in claim 24, wherein the control portion includes means for determining drive rates of the on-vehicle loads in accordance with the priority points thereof.
- 5 27. A power supply apparatus as recited in claim 1, wherein the control portion includes means for detecting whether or not the amount of electric power stored in the power storage portion is smaller than a prescribed value, and means for, when it is detected that the amount of electric power stored in the power storage
- 10 portion is smaller than the prescribed value, increasing the sum of feedable electric power or decreasing the sum of required electric power.
- 15 28. A power supply apparatus as recited in claim 1, wherein the control portion includes means for detecting whether or not the amount of electric power stored in the power storage portion is smaller than a prescribed value, and means for, when it is detected that the amount of electric power stored in the power storage portion is not smaller than the prescribed value, decreasing the sum
- 20 of feedable electric power.
29. A power supply apparatus as recited in claim 10, wherein the power generating portion includes an electric generator/motor driven by an engine, and wherein the control portion includes
- 25 means for, in cases where the position of the vehicle is judged to be in a prescribed engine-drive-regulated region on the basis of

- information received from a vehicle position detecting device provided on the vehicle or from an external with respect to the vehicle or in response to an engine-drive-regulation signal received from an external with respect to the vehicle, suspending or
- 5 decelerating the engine, and means for, in cases where a resultant decrease in the sum of feedable electric power causes the sum of feedable electric power to be lower than the sum of required electric power, decreasing the sum of required electric power or adjusting the interchange electric power to compensate for the
- 10 decrease in the sum of feedable electric power.

30. A power supply apparatus as recited in claim 29, wherein the control portion includes means for judging whether or not the vehicle is in the prescribed engine-drive-regulated region and the
- 15 present time is in a prescribed engine-drive-regulated time range, and means for suspending or decelerating the engine when it is judged that the vehicle is in the prescribed engine-drive-regulated region and the present time is in the prescribed engine-drive-regulated time range.

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31. An engine-drive-regulation supporting apparatus mounted on a vehicle driven by an engine, the apparatus comprising:

engine-drive-regulated region detecting means including at least one of means for judging whether or not the position of the

25 vehicle is in a prescribed engine-drive-regulated region on the basis of information received from a vehicle position detecting device

provided on the vehicle or from an external with respect to the vehicle, and means for receiving an engine-drive-regulation signal from an external with respect to the vehicle; and

- 5 engine-drive regulating means for giving a notice to a vehicle driver, suspending the engine, or decelerating the engine when it is judged that the position of the vehicle is in the prescribed engine-drive-regulated region or in response to reception of the engine-drive-regulation signal.
- 10 32. An engine-drive-regulation supporting apparatus as recited in claim 31, wherein the engine-drive regulating means includes:
means for judging whether or not the vehicle is in the prescribed engine-drive-regulated region and the present time is in a prescribed engine-drive-regulated time range; and
- 15 means for giving the notice to the vehicle driver, suspending the engine, or decelerating the engine when it is judged that the vehicle is in the prescribed engine-drive-regulated region and the present time is in the prescribed engine-drive-regulated time range.
- 20 33. A power supply apparatus as recited in claim 29, further comprising a manually-operated engine stop switch, and means provided in the control portion for stopping the engine in response to operation of the engine stop switch.